

CLAIMS:

What is claimed is:

1. A method for performing OTDM, said method comprising the following steps:

5 a) generating n bit streams of approximately B Gb/s from respectively n tunable laser beams having respectively wavelengths of $\lambda_1, \lambda_2, \dots$ and λ_n ;

10 b) generating from said n bit streams n group velocity dispersed bit streams by introducing group velocity dispersion into said n bit streams;

15 c) combining said n group velocity dispersed bit streams into a composite bit stream of approximately nB Gb/s; and

20 d) in response to misalignment of bits within said composite bit stream, tuning said $\lambda_1, \lambda_2, \dots$ and λ_n to create the proper OTDM time differential between consecutive bits within said composite bit stream.

15 2. The method of Claim 1, further comprising the following steps:

25 e) generating a single-wavelength composite bit stream of approximately wavelength λ_v and nB Gb/s by operating on said composite bit stream with a wavelength converter; and

30 f) in response to misalignment of bits within said single-wavelength composite bit stream, tuning said $\lambda_1, \lambda_2, \dots$ and λ_n to create the proper OTDM time differential between consecutive bits within said single-wavelength composite bit stream.

3. An OTDM transmitter, comprising:

a) n channels of bit streams D_1, D_2, \dots and D_n having respectively wavelengths of $\lambda_1, \lambda_2, \dots$ and λ_n , wherein for $j = 1$ to n , the j -th channel comprises:

j1) a tunable laser source S_j providing a bit stream B_j of approximately B

Gb/s; and

5 j2) a group velocity dispersive element E_j coupled to said S_j , introducing
group velocity dispersion into said B_j to generate said D_j ;

b) a combiner coupled to said n channels and adapted to optically combine said D1,

D2, ..., and Dn into a composite bit stream of approximately nB Gb/s; and

c) a wavelength converter coupled to said combiner and adapted to convert said site bit stream into a single-wavelength composite bit stream of approximately nB to be transmitted through an optical link, wherein OTDM time differential can be Δ between consecutive bits of said single-wavelength composite bit stream by tuning λ_1, \dots and λ_n .

15 4. A method for performing OTDM transmission, said method comprising the
steps of:

a) generating n bit streams of approximately B Gb/s from respectively n tunable laser beams having respectively initial wavelengths of $\lambda_1, \lambda_2, \dots$ and λ_n ;

b) generating n group velocity dispersed bit streams by introducing group velocity

20 dispersion into said n bit streams;

c) combining said n group velocity dispersed bit streams into a composite bit stream of approximately nB Gb/s;

d) generating a single-wavelength composite bit stream of wavelength λ_v by wavelength converting said composite bit stream with a wavelength converter;

e) in response to misalignment of bits within said single-wavelength composite bit stream, tuning said $\lambda_1, \lambda_2, \dots$ and λ_n to create the proper OTDM time differential between 5 consecutive bits within said single-wavelength composite bit stream; and

f) transmitting said single-wavelength composite bit stream by launching said single-wavelength composite bit stream into an optical transmission link.

5. A WDM system, comprising:

a) m OTDM channels, wherein for $k = 1$ to m , the k -th OTDM channel comprises:

10 k1) n channels V_{k1}, V_{k2}, \dots and V_{kn} providing respectively bit streams D_{k1}, D_{k2}, \dots and D_{kn} having respectively wavelengths of $\lambda_{k1}, \lambda_{k2}, \dots$ and λ_{kn} , wherein for $j = 1$ to n , the j -th channel V_{kj} comprises:

15 kj1) a tunable laser source S_{kj} providing a bit stream B_{kj} of approximately B Gb/s; and

kj2) a group velocity dispersive element E_{kj} coupled to said S_{kj} , introducing group velocity dispersion into said B_{kj} to generate said D_{kj} ;

k2) a combiner coupled to said n channels and adapted to optically combine said n bit streams into a composite bit stream U_k ;

20 k3) a wavelength converter coupled to said combiner and adapted to convert said composite bit stream into a single-wavelength composite bit stream A_k of

wavelength λ_{vk} , wherein the proper OTDM time differential can be created between consecutive bits of said A_k by tuning $\lambda_{k1}, \lambda_{k2}, \dots$ and λ_{kn} ; and

5 b) a WDM multiplexer coupled to said m OTDM channels, with said WDM multiplexer adapted to generate a composite optical signal with a data rate of approximately mnB Gb/s.

6. An OTDM subsystem for performing optical time-division-multiplexing, said OTDM subsystem comprising:

a) n channels of bit streams D_1, D_2, \dots and D_n having respectively wavelengths of $\lambda_1, \lambda_2, \dots$ and λ_n , wherein for $j = 1$ to n , the j -th channel comprises:

10 j1) a tunable laser source S_j providing a bit stream B_j of approximately B Gb/s; and

j2) a group velocity dispersive element E_j coupled to said S_j , introducing group velocity dispersion into said B_j to generate said D_j ;

b) a combiner coupled to said N channels and adapted to optically combine said

15 D_1, D_2, \dots and D_n into a composite bit stream of approximately nB Gb/s, wherein OTDM time differential can be created between consecutive bits of said composite bit stream by tuning $\lambda_1, \lambda_2, \dots$ and λ_n .

7. The Claims of 2-6, wherein return-to-zero (RZ) format is used in generating bit streams.

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8. The Claims of 2-6, wherein said B Gb/s is 10 Gb/s, and wherein said n is 4.

9. The Claims of 2-6, wherein said B Gb/s is 40 Gb/s, and wherein said n is 4.

10. The Claims of 2-5, wherein said wavelength converter is a vertical lasing semiconductor optical amplifier (VLSOA), and wherein said single wavelength is generated
5 from the vertical lasing of said VLSOA.

11. The Claims of 2-5, wherein said wavelength converter uses four-wave mixing.

12. The Claims of 2-5, wherein said wavelength converter is a MZ-SOA.

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13. The Claims of 2-5, wherein said wavelength converter is a SOA.

14. The method of Claim 1, wherein said n bit streams are generated by
modulating respectively n CW tunable laser sources.

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15. The method of Claim 1, wherein said n bit streams are generated respectively
by n directly modulated tunable laser sources.

16. The OTDM transmitter of Claim 3, wherein for said j=1 to n, said Sj in said j-
20 th channel is a CW tunable laser that is coupled to a modulator Mj, said Mj modulating a
laser beam Lj generated by said Sj into said Bj.

17. The OTDM transmitter of Claim 3, wherein for said $j=1$ to n , said S_j in said j -th channel is a tunable laser that is directly modulated.

18. The method of Claim 4, wherein said n bit streams are generated by
5 modulating respectively n CW tunable laser sources.

19. The method of Claim 4, wherein said n bit streams are generated respectively
by n directly modulated tunable laser sources.

10 20. The WDM system of Claim 5, wherein for $k=1$ to m and $j = 1$ to n , said
tunable laser source S_{kj} in said j -th channel V_{kj} is a tunable CW laser source that is coupled
to a modulator M_{kj} , said M_{kj} modulating a laser beam L_{kj} produced from said S_{kj} into said
stream B_{kj} .

15 21. The WDM system of Claim 5, wherein for $k=1$ to m and $j = 1$ to n , said
tunable laser source S_{kj} in said j -th channel V_{kj} is a tunable laser that is directly modulated.

22. The OTDM subsystem of Claim 6, wherein for said $j=1$ to n , said S_j in said j -th channel is a CW tunable laser that is coupled to a modulator M_j , said M_j modulating a
20 laser beam L_j generated by said S_j into said B_j .

23. The OTDM subsystem of Claim 6, wherein for said $j=1$ to n , said S_j in said j -th channel is a tunable laser that is directly modulated.